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Patentability**



IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

Applicant(s): Takeshi NAGASHIMA et al  
Serial No.: 10/073,213  
Filed: February 13, 2002  
For: INK-JET RECORDING MATERIAL  
Art Unit: 1774  
Examiner: Betelhem Shewareged

Honorable Commissioner of Patents  
and Trademarks  
Washington, D.C. 20231

DECLARATION UNDER 37 CFR 1.132

SIR:

I. I, Takeshi NAGASHIMA, a first inventor of this case,  
declare and say as follows.

I am one of the joint inventors of the present U.S.  
Patent Application as identified above and understand the  
English language. I studied the Official Action dated July 17,  
2006 received in said application.

In order to certify that the term "translucency"  
mentioned at column 4, line 65 of the reference Ohbayashi et  
al. (US 6,436,515 B1) is a translation error from Japanese-  
language into English-language and it should read "opacity", I  
have conducted comparative experiments as mentioned below  
under my supervision.

II. Comparative experiments

An object of the experiments is to show that the

Ohbayashi reference does not intend to describe a resin-coated support having a transparency of 80% or more but to intend the same having an opacity of 80% or more.

As mentioned in a response to the previous Office Action, at column 4, lines 65-67 of Ohbayashi et al., "Translucency" has been measured by a method specified in "JIS-P-8138". An English-language translation of "JIS-P-8138" prepared by Japanese Standard Association is attached to the response filed on May 1, 2006 as an Information Disclosure Statement. As described in the English-language translation of "JIS-P-8138", this method is not a method for measuring transparency of a material but a method for measuring opacity of a material. Thus, it would be clear that the term "translucency" mentioned at column 4, lines 65-67 of Ohbayashi et al. did not mention correctly.

Next, a support described at column 10, lines 31-41 of Example 1 of Ohbayashi et al. was prepared. That is, low density polyethylene having a density of 0.92 was applied with an extrusion coating method at a thickness of 30  $\mu\text{m}$  onto the reverse surface of a 170  $\text{g}/\text{m}^2$  weight photographic base paper having a moisture content of 6.5% by weight. Then, low density polyethylene having a density of 0.92, comprising 5.5% by weight of anatase type titanium oxide was applied at a thickness of 35  $\mu\text{m}$  onto the surface with a melt extrusion coating method.

Opacity of the thus prepared support was prepared according to the method of JIS-P-8138 (method A).

Measurement device: Digital hunter reflection meter

(manufactured by TOYO SEIKI SEISAKUSHO LTD.)

Calculation of opacity:  $R_{0.89}$  ... reflectance of sample when  
paper backing white plate is  
used.

$R_0$  ... reflectance of sample when paper  
backing black plate is used.

Opacity ...  $(R_0/R_{0.89}) \times 100$

Number of samples: 5 (five) samples

The results are shown in the following table.

Sample No.	$R_{0.89}$	$R_0$	Opacity
1	87.8	85.4	97.3
2	88.7	85.9	96.8
3	88.7	85.3	96.2
4	87.8	85.7	97.6
5	87.8	85.2	97.0
Average value	88.2	85.5	97.0

As can be seen from the results shown in the above table,  
no sample showed transparency of 80% or more but all the  
sample showed opacity of 80% or more.

From the results shown in the above table, it would be  
clear that Ohbayashi et al. did not intend to provide a  
support having a transparency of 80% or more but did intend to  
provide a support having an opacity of 80% or more.

### III. Conclusion

I believe that the above results would clearly show that  
the description of Ohbayashi et al was wrong and contained a  
serious translation error. Thus, I do not believe that the

present invention is obvious over Ohbayashi et al.

IV. I further declare that all statements made herein of my own knowledge are true and that all statements made in information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001, of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: October 6, 2006

Takeshi Nagashima

Takeshi NAGASHIMA

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

DECLARATION OF ACCURACY OF TRANSLATION  
IN LIEU OF SWORN TRANSLATION (37 C.F.R. 1.55 & 1.68)

The undersigned translator, Toshio Shimizu of TSUKUNI & ASSOCIATES having an office at 1-22-12, Toranomom, Minato-ku, Tokyo, Japan certifies and declares that:

(1) I am fully conversant both with the Japanese and English languages.

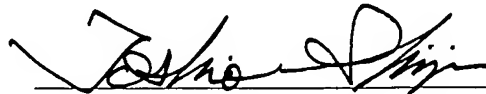
(2) I have carefully compared the attached partial English language translation of Japanese Laid-Open Patent Publication Number 2000-355160, published December 26, 2000, with the original Japanese-language patent specification.

(3) The translation is, to the best of my knowledge, and belief, an accurate translation from the original into the English language.

The undersigned declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the matter with which this translation is used.

Date:

November 2, 2006



Toshio Shimizu

[0028] A preferred support in the present invention is a support in which both surfaces of paper are coated with a plastic resin, and the most preferred is a support in which both surfaces of paper is covered with a polyolefin resin.

[0029] In particular, a recording medium, in which both surfaces of paper are coated with a polyolefin resin such as polyethylene, etc., is used as a support and an ink-receptive layer is provided thereon, is preferred as a print having high quality similar to a print of a silver salt photography, in the points that it is excellent in the effects of the present invention as well as it is a relatively low cost as compared to a plastic film, its heavy and thick feeling, flexibility, smoothness and glossiness.

[0030] In the following, a support both surfaces of paper are coated with a plastic resin which is a preferred support of the present invention is explained.

[0031] Paper to be used as a support of the present invention mainly comprises wood pulp, and, if necessary, it is made paper by using synthetic fibers such as synthetic pulp including polypropylene, or using synthetic resin such as Nylon or polyester, etc., in addition to the wood pulp. As the wood pulp, there may be used either of LBKP, LBSP, NBKP, NBSP, LDP, NDP, LDP, and it is preferred to use more amount of LBKP, NBSP, LBSP, NDP or LDP containing a large amount of short fiber components. Provided that a ratio of LBSP and/or LDP is/are preferably 10% by weight to 70% by weight.

[0032] As the above-mentioned pulp, chemical pulp (sulfate pulp or sulfite pulp) containing less impurities is preferably used, and a pulp in which whiteness is improved by carrying out bleaching treatment is also useful.

[0033] Into the paper, a sizing agent such as higher fatty acid, alkyl ketene dimer, etc., a white pigment such as calcium carbonate, talc, titanium oxide, etc., a paper strengthening agent such as starch, polyacrylamide, polyvinyl alcohol, etc., a fluorescent brightener, a moisture retaining agent such as a polyethylene glycol, etc., a dispersing agent,

a flexibilizing agent such as a quaternary ammonium compound, etc., may be optionally added.

[0034] Freeness of the pulp to be used for paper-making is preferably 200 to 500 ml according to the standard of CSF, and fiber length after beating is preferably 30 to 70% with a sum of mass% remained in 24 mesh and mass% remained in 42 mesh regulated by JIS-P-8207. Incidentally, mass% remained in 4 mesh is preferably 20% by weight or less.

[0035] A basis weight of the paper is preferably 50 to 250 g, particularly preferably 70 to 200 g. A thickness of the paper is preferably 50 to 210  $\mu\text{m}$ .

[0036] To the paper may be provided high smoothness by subjecting it to calendar treatment during the paper-making or after paper-making. A density of paper is generally 0.7 to 1.2  $\text{g}/\text{m}^2$  (JIS-P-8118). Moreover, stiffness of the base paper is preferably 20 to 200 g under the conditions regulated by JIS-P-8143.

[0037] Onto the surface of the paper may be coated a surface sizing agent, and as the surface sizing agent, the same sizing agent as the size which can be added into the above-mentioned base paper.

[0038] A pH of the paper is preferably 5 to 9 when it is measured by a hot water extraction method regulated in JIS-P-8113.

Next, the plastic resin to be coated on the both surfaces of the paper is explained.

[0039] As the plastic resin to be used for the above purpose, a polyolefin resin can be particularly preferably used, and as the polyolefin resins, polyolefins such as polyethylene, polypropylene, polyisobutylene, a copolymer mainly comprising ethylene and propylene are preferred, and polyethylene is particularly preferred, and polyethylene is particularly preferred.

[0040] In the following, particularly preferred polyethylene is explained. The polyethylene which covers the front surface and back surface of paper is mainly a low-density polyethylene (LDPE) and/or a high-density polyethylene (HDPE), and other LLDPE or polypropylene, etc., may be partially used.



[0041] In particular, the polyolefin layer at the coating layer side is preferably those in which a rutile or anatase type titanium oxide is added to the polyolefin whereby opacity and whiteness are improved. A content of the titanium oxide is generally 3 to 20% by weight, preferably 4 to 13% by weight based on the polyolefin.

[0042] Into the polyolefin layer, a pigment or fluorescent brightener for carrying out adjustment of white background and having high heat resistance may be added.

[0043] As a colored pigment, there may be mentioned, for example, ultramarine blue, prussian blue, cobalt blue, phthalocyanine blue, manganese blue, cerulean, tungsten blue, molybdenum blue, anthraquinone blue, etc.

[0044] As a fluorescent brightener, there may be mentioned, for example, dialkylaminocoumarine, bisdimethylaminostilbene, bismethylaminostilbene, 4-alkoxy-1,8-naphthalenedicarboxylic acid-N-alkylimide, bisbenzoxazolylethylene, dialkylstilbene, etc.

[0045] An amount of the polyethylene at the front and back of the paper to be used is selected so that a thickness of an ink-receptive layer or curl under low-humidity and high-humidity is optimized after providing a back layer, and in general, the polyethylene layer at the side at which the ink-receptive layer is provided is in the range of 15 to 40  $\mu\text{m}$  and the back layer side is 10 to 30  $\mu\text{m}$ .

[0046] Further, the support coated by the above-mentioned polyethylene preferably has the following characteristics.

[0047] (1) Tensile strength: this is a strength regulated by JIS-P-8113, and a longitudinal direction is preferably 2 to 30 kg, and a lateral direction is preferably 1 to 20 kg,

(2) Tear strength: it is preferably 10 to 200 g in the longitudinal direction and 20 to 200 g in the lateral direction according to the method regulated in JIS-P-8116,

(3) Compression elastic modulus  $\geq 9.8 \times 10^7$  Pa,

(4) Opacity: it is preferably 80% or more, particularly preferably 85 to 98% when measured by the method regulated in JIS-P-8138,

(5) Whiteness: it is preferably  $L^*=80$  to 95,  $a^*=-3$  to +5, and

b\*=-6 to +2 which are L\*, a\* and b\* regulated by JIS-Z-8729,

(6) Clark stiffness: a support in which a clark stiffness in the conveying direction of a recording medium of 50 to 300 cm<sup>2</sup>/100 is preferred,

(7) Moisture content in the base paper: it is preferably 4 to 10% by weight based on core paper.

# PATENT ABSTRACTS OF JAPAN

MECHANICAL  
TRANSLATION  
FOLLOWS

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(71)Applicant: KONICA CORP

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(30)Priority

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## (54) INK JET RECORDING MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an ink jet recording medium for obtaining an image having no image irregularity and a sense of high grade by improving a grade due to a surface gloss without remarkable gloss difference in an image-like state between a printed portion and a non-printed portion.

SOLUTION: The ink jet recording medium comprises an ink absorption layer provided on a support in such a manner that a centerline mean roughness (Ra) measured when a measuring length specified by JIS-B-0601 on the surface of the layer side is 2.5 mm and a cut-off value is 0.8 mm is 0.8 to 4.0  $\mu$ m, and a 60-degree mirror surface glossiness according to JIS-Z-8741 is 10 to 30%.

## LEGAL STATUS

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[Date of sending the examiner's decision of rejection]

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[Patent number] 3726632

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[Date of extinction of right]

## CLAIMS

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### [Claim(s)]

[Claim 1] The ink jet record medium characterized by the 60-degree specular gloss according [ the center line average of roughness height (Ra) when measuring the measurement die length specified to JIS-B -0601 of the front face by the side of the ink absorption layer prepared on the base material with 2.5mm and the cut-off value of 0.8mm ] to 0.8-4.0 micrometers and JIS-Z -8741 being 10 - 30%.

[Claim 2] The ink jet record medium which has an ink absorption layer on the base material whose center line average of roughness height (Ra) when measuring the measurement die length specified to JIS-B -0601 of the front face of the side which has an ink absorption layer with 2.5mm and the cut-off value of 0.8mm is 1.0-5.0 micrometers, and is characterized by the 60-degree specular gloss according [ the front face by the side of this ink absorption layer ] to JIS-Z -8741 being 10 - 30%.

[Claim 3] The ink jet record medium according to claim 1 or 2 characterized by a base material being the paper covered with polyolefin resin in both sides.

[Claim 4] The ink jet record medium according to claim 1, 2, or 3 characterized by an ink absorption layer being the porous anodic oxide film which has an opening.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Field of the Invention] This invention relates to the ink jet record medium which gives an ink jet print with the high-class feeling improves the flash by surface gloss and it was made for a gloss difference not to produce in the shape of an image about a high-definition ink jet record medium.

#### [0002]

[Description of the Prior Art] In connection with the fast technological innovation of ink jet record in recent years, print quality is equal to the print obtained by the film photo. Although it depends on three, a printer, ink, and an ink jet record medium, for the print quality acquired by ink jet record, if it sees in respect of image quality, front 2 persons' latest technological innovation will be large, and will become very important in print quality with the final difference of the engine performance of an ink jet record medium (only henceforth a record medium).

[0003] For this reason, in order to obtain the print near a silver salt photoprint by ink jet record, amelioration of versatility [ viewpoint / of a record medium ] has been made from the former.

[0004] Although the base material itself is roughly classified into what is ink absorptivity, and the thing which prepared the ink absorption layer on the base material like paper as an ink-jet record medium, since maximum density high since ink permeates directly into a base material is not obtained, or the base material itself absorbs an ink solvent and the former generates remarkable Siwa in the shape of an image, the print with a high-class feeling is hard to be obtained, and an ink absorption \*\*\*\* beam thing is desirable.

[0005] The ink absorption layer of a swelling mold and the opening mold ink absorption layer are known greatly as an ink absorption layer prepared on a base material.

[0006] A swelling mold ink absorption layer is constituted considering hydrophilic polymers, such as gelatin, polyvinyl alcohol, a polyvinyl pyrrolidone, or polyethylene oxide, as a subject.

[0007] Although an opening mold ink absorption layer has an opening in a layer and some classes are in the process, a typical thing is a layer which has a small amount of hydrophilic polymer and a lot of particles, an opening is formed among particles and it mainly absorbs ink here.

[0008] Although it may depend for a surface condition on an individual taste, glossiness required as a print with a high-class feeling and other properties may be required for the purpose to be used.

[0009] For example, the reflected light [ wanting to make hard to attach dirt with solid one, such as a paste, to make into what a fingerprint cannot attach easily ] is too strong, and appreciates, and there are cases, such as wanting to avoid a \*\*\*\*\* condition.

[0010] For example, in order to semigloss-ize a front face, it is common to make the irregularity of the height of 1-micrometer order form in a front face, but when it records on the record medium which was made to carry out surface roughening of the front face moderately, and was obtained by the ink jet, there is a problem from which gloss changes in the shape of an image, and glossiness tends to become an ununiformity. This problem needs to be improved, in order to spoil the print grace of the high ink jet print of especially a high-class feeling.

[0011] Although not clarified, when it records by the ink jet, since the organic solvent of low vaporization remains in an ink absorption layer, this cause is presumed for a difference to arise in the shape of an image in irregularity with a detailed front face.

[0012] If the uneven gloss difference of the shape of such an image arises, it will not become the print which a flash arises in an image side, turns into an unnatural print, and has a high-class feeling.

[0013] This problem becomes remarkable when a base material does not absorb an ink solvent, but even if it is the case where a base material absorbs ink, when it records by the ink jet, a concavo-convex difference arises on a front face slightly, and a gloss difference arises in the shape of an image.

[0014]

[Problem(s) to be Solved by the Invention] The technical problem which this invention is

made in view of the above-mentioned actual condition, and this invention tends to solve is to improve the flash by surface gloss and offer the ink jet record medium with which an image with the high-class feeling which moreover does not have image nonuniformity is obtained, without producing a gloss difference remarkable in the shape of an image in the print section and the non-printing section.

[0015]

[Means for Solving the Problem] The above-mentioned purpose of this invention is attained by the following configurations.

[0016] 1. Ink jet record medium characterized by 60-degree specular gloss according [ the center line average of roughness height (Ra) when measuring the measurement die length specified to JIS-B -0601 of the front face by the side of the ink absorption layer prepared on the base material with 2.5mm and the cut-off value of 0.8mm ] to 0.8-4.0 micrometers and JIS-Z -8741 being 10 - 30%.

[0017] 2. Ink jet record medium which has ink absorption layer on base material whose center line average of roughness height (Ra) when measuring measurement die length specified to JIS-B -0601 of front face of side which has ink absorption layer with 2.5mm and cut-off value of 0.8mm is 1.0-5.0 micrometers, and is characterized by 60-degree specular gloss according [ the front face by the side of this ink absorption layer ] to JIS-Z -8741 being 10 - 30%.

[0018] 3. Said 1 characterized by base material being paper covered with polyolefin resin in both sides, or ink jet record medium given in 2.

[0019] 4. Said 1 and 2 which are characterized by ink absorption layer being porous anodic oxide film which has opening, or ink jet record medium given in 3.

[0020] Hereafter, this invention is further explained to a detail. The ink jet record medium of this invention has an ink absorption layer on a base material.

[0021] Although both an absorptivity base material and a non-absorptivity base material can be used for the base material used for the record medium of this invention, it is desirable from a non-absorptivity base material not having generating of Siwa, and being able to form a semigloss side easily again.

[0022] Since it permeates into a base material gradually while also saving the color which Siwa tended to generate in the case of the absorptivity base material with which a base material absorbs an ink solvent, and was dyed in the ink absorption layer, it is in the inclination for concentration to fall.

[0023] On the other hand, in the ink jet record medium which prepared the ink absorption layer on the non-absorptivity base material with which a base material does not absorb ink at all, the ink jet print which does not have the above-mentioned problem and has a high-class feeling is obtained.

[0024] Although the paper base material which made natural pulp the subject especially as an absorptivity base material is typical, you may be the mixture of a synthetic pulp and natural pulp.

[0025] The base material which covered both sides of a plastic resin film base material

or paper with the plastic resin film as a non-absorptivity base material is mentioned.

[0026] As a plastic resin film base material, polyester film, a polyvinyl chloride film, a polypropylene film, a cellulose triacetate film, a polystyrene film, etc. are mentioned.

[0027] Although these plastic resin films can also use a transparent thing or a translucent thing, its transparent thing is desirable.

[0028] A desirable base material is a base material which covered both sides of paper with plastic resin in this invention, and the base material which covered both sides of paper with polyolefin resin is the most desirable.

[0029] The record medium which prepared the ink absorption layer on it using the base material which covered both sides of paper with polyolefin resin, such as polyethylene, especially as a base material is desirable as a print which is excellent upwards on the effectiveness of this application, and has a high-class feeling near the print of a film photo in respect of that it is low cost comparatively, its profound feeling and ductility, smooth nature, glossiness, etc. compared with plastic film.

[0030] Hereafter, this invention explains the base material which covered with plastic resin both sides of the paper which is a desirable base material.

[0031] The paper used for the base material of this invention uses wood pulp as the main raw material, and, in addition to wood pulp, paper making is carried out using synthetic fibers, such as synthetic pulps, such as polypropylene, or nylon, and polyester, if needed. Although both LBKP, LBSP, NBKP, NBSP LDP and NDP LUKP and NUKP can be used as wood pulp, it is desirable to use more many [ for a staple fiber ] LBKP, NBSP(s), LBSP(s), and NDP(s) and LDP(s). However, it reaches LBSP or the ratio of LDP has desirable 10 mass % - 70 mass %.

[0032] The pulp of the above-mentioned pulp which chemical pulp with few impurities (sulfate pulp and sulfite pulp) was used preferably, performed bleaching processing again, and raised the whiteness degree is also useful.

[0033] Kaminaka can add suitably flexible-ized agents, such as moisture hold-back agents, such as paper reinforcing agents, such as white pigments, such as sizing compounds, such as a higher fatty acid and an alkyl ketene dimer, a calcium carbonate, talc, and titanium oxide, starch, polyacrylamide, and polyvinyl alcohol, a fluorescent brightener, and polyethylene glycols, a dispersant, and the 4th class ammonium compound, etc.

[0034] The freshness of the pulp used for paper making has desirable 200-500ml by convention of CSF, and 30 - 70% has the desirable sum of 24-mesh residue mass % and mass % of the 42-mesh residue as which the fiber length after beating is specified to JIS-P -8207. In addition, as for mass % of the four-mesh residue, it is desirable that it is below 20 mass %.

[0035] The basis weight of paper has 50-desirable 250g, and 70-especially its 200g are desirable. The thickness of paper has desirable 50-210 micrometers.

[0036] After a paper-making phase or paper making, calender processing of the paper can be carried out and it can also give the Takahira slippage. A paper consistency has

common 0.7 - 1.2 g/m<sup>2</sup> (JIS-P -8118). Furthermore, stencil paper stiffness has 20-desirable 200g on the conditions specified to JIS-P -8143.

[0037] A surface sizing compound may be applied to a paper front face, and the sizing compound same as a surface sizing compound as said size which can carry out the Hara Kaminaka addition can be used.

[0038] pH of paper explains the plastic resin which covers both sides of this paper to a degree with desirable it being 5-9, when measured by the hot water extraction method specified by JIS-P -8113.

[0039] Especially polyethylene is desirable although polyolefines, such as a copolymer which can use polyolefin resin preferably and specifically makes polyethylene, polypropylene, a polyisobutylene, ethylene, and a propylene a subject as polyolefin resin especially as plastic resin used for this purpose, are desirable.

[0040] Hereafter, especially desirable polyethylene is explained. Mainly although the polyethylene which covers a paper front face and a rear face is the polyethylene (LDPE) of a low consistency, and/or polyethylene (HDPE) of high density, a part of other LLDPE(s), polypropylene, etc. can be used for it.

[0041] As for especially the polyolefine layer by the side of a spreading layer, what added the titanium oxide of a rutile or an anatase mold in polyolefine, and improved opacity and a whiteness degree is desirable. a titanium oxide content -- polyolefine -- receiving -- usually -- three to 20 mass % -- it is four to 13 mass % preferably.

[0042] The heat-resistant high pigment and heat-resistant high fluorescent brightener for adjusting a white ground into a polyolefine layer can be added.

[0043] As a color pigment, ultramarine blue, Berlin blue, cobalt blue, a copper phthalocyanine blue, manganese blue, a cerulean, tungsten blue, molybdenum blue, the Anthraquinone blue, etc. are mentioned.

[0044] As a fluorescent brightener, it is for example, a dialkylamino coumarin, a bisdimethyl amino stilbene, a bis-methylamino stilbene, and 4-alkoxy. - 1, 8-naphthalene dicarboxylic acid-N-alkyl imide, bis-bends oxazolyl ethylene, a dialkyl stilbene, etc. are mentioned.

[0045] After preparing the thickness of an ink absorption layer, and a back layer, the amount of the polyethylene used of the front flesh side of paper is damp and range whose 15-40-micrometer and back layer side the polyethylene layer of the side which generally applies an ink absorption layer is 10-30 micrometers, although it is chosen so that the curl by highly-humid-izing may be optimized.

[0046] Furthermore, it is desirable that the covering paper base material has the following properties with the above-mentioned polyethylene.

[0047] A lengthwise direction by the reinforcement specified by :JIS-P -8113 in hauling strength \*\* 2-30kg, A lengthwise direction by the convention approach by \*\* tear on-the-strength:JIS-P -8116 with desirable a longitudinal direction being 1-20kg 10-200g, \*\* compressibility  $\geq 9.8 \times 10^7$  Pa with desirable longitudinal direction 20-200g, When it measures by the approach specified to JIS-P -8138, Opacity : \*\* 80% or more,



L\* as which 85 - 98% is especially specified by :JIS-Z -8729 in desirable \*\* whiteness, That a\* and b\* are L\*=80-95, a\*=-3+5, and b\*=-6+2 [ desirable ] \*\* \*\* Hara Kaminaka's moisture with the desirable base material whenever [ Clerks upright / the conveyance direction of :record medium / whose ] is 2/100 50-300cm whenever Clerks upright : 4 - 10 mass % is desirable to inside paper.

[0048] The center line average of roughness height (Ra) when invention of claim 1 of this invention measures the measurement die length specified to JIS-B -0601 (1982) of the front face by the side of the ink absorption layer prepared on the base material with 2.5mm and the cut-off value of 0.8mm is the ink jet record medium with which 60-degree specular gloss by 0.8-4.0 micrometers and JIS-Z -8741 (1983) is characterized by being 10 - 30%.

[0049] The front face by the side of an ink absorption layer is a particle side which has regular or irregularity-irregularity, and is a field as the 60-degree specular gloss according [ the center line average of roughness height (Ra) when the measurement die length specified to JIS-B -0601 measures with 2.5mm and the cut-off value of 0.8mm ] to 0.8-4.0 micrometers and JIS-Z -8741 shows 10 - 30% in.

[0050] Moreover, a flash can be prevented, without reducing gloss remarkably also in feeling of \*\* according to such a field.

[0051] That is, surface glossiness is moderately controlled by the irregularity of this front face, an unnecessary flash is lost, and a big difference does not arise in glossiness in the print part and the non-printing part at the time of moreover carrying out ink jet record, but the print without nonuniformity which has a high-class feeling in feeling of \*\* is obtained.

[0052] In the record medium of invention of claim 1 of this invention, surface flash depressor effect is remarkable in said Ra being 0.8 micrometers or more, and if Ra is 4.0 micrometers or less, the condition that ink becomes easy to collect on a part for heights can be prevented, and, therefore, generating of Pacific cod-like nonuniformity can be suppressed. Furthermore, when an ink absorption layer is the hard porous anodic oxide film which has an opening, the crack of the coat which the way of 4.0 micrometers or less tends to produce [ Ra ] at the time of manufacture is suppressed. The desirable range of Ra is 0.9-3.0 micrometers.

[0053] This particle side gives 5-30 irregularity whose differences of elevation are 3-20 micrometers to spacing of 3mm. What gave 5-15 irregularity of 5-20 micrometers of differences of elevation to spacing which is 3mm when a particle side was a regular configuration is desirable, and when a particle side is an irregular configuration, what gave 10-30 irregularity whose differences of elevation are 5-20 micrometers to spacing of 3mm is desirable.

[0054] A surface characteristic which is acquired by this invention is not acquired by only the mat agent conventionally used for an ink absorption layer.

[0055] Into a flat ink absorption layer, if a well-known mat agent is made to contain, convex voice will usually mainly be formed on an ink absorption layer front face. If it is

going to control glossiness in the range of a desired value only by the convex formed of a mat agent, it will be necessary to use a mat agent with quite big mean particle diameter from a well-known mat agent, and surface roughness cannot control in the range of a desired value, consequently the effectiveness of this application is not acquired upwards, an abrasion will tend to be attached or the feeling of \*\* on the front face of a print will be worsened. Therefore, both surface roughness and glossiness cannot be satisfied to the approach of making an ink absorption layer containing a mat agent, and the surface characteristic of this invention cannot be acquired.

[0056] The record medium of this invention differs from what is obtained by having the particle side in which a front face has the irregularity of specific magnitude, and is obtained by only the conventional mat agent.

[0057] After preparing the ink absorption layer on it beforehand using the base material which performed mold attachment processing, for example as a production means which makes the front face of an ink absorption layer a particle side or preparing an ink absorption layer in a smooth base material, mold attachment of the front face may be carried out. Since it is hard to attach uniform irregularity according to the approach of carrying out after treatment to an ink absorption layer like the latter, the former is desirable.

[0058] The former is desirable when it is a porous anodic oxide film especially with a comparatively hard ink absorption layer. Therefore, when preparing an ink absorption layer on it using the base material which performed mold attachment processing beforehand, surface roughness Ra of this base material needs to make it higher than the difference of elevation of the irregularity in the particle side of the front face by the side of the ink absorption layer for which it asks, for example, it is desirable that surface roughness Ra of this base material is 1.0-5.0 micrometers.

[0059] Although the specular gloss according [ the record medium of this invention ] to JIS-Z -8741 of the front face by the side of an ink absorption layer is 10 - 30%, this surface glossiness is controllable with the irregularity of the base material mentioned above, the detailed structure itself which the ink absorption layer itself has, the mat agent used auxiliary, etc.

[0060] There is an inclination for whenever [ surface mat-ized ] to be too high and to tend to become an indistinct image when said glossiness is less than 10%, and for gloss nonuniformity (flash) to become easy to be conspicuous [ with the difference of few glossiness on the front face of an image ] after ink jet record.

[0061] On the other hand, when said glossiness exceeds 30%, the record medium with which the glossiness of an image side is too high with a record medium, it is hard coming to call it a semigloss side, and a high-class feeling generally has it is not obtained.

[0062] It is obtained by the glossiness of such range making the outermost superficial layer of an ink absorption layer the most uniform possible configuration, and lessening the unnecessary particle to which gloss is reduced as much as possible.

[0063] Although a mat agent can also be contained in the outermost surface of said ink absorption layer, gloss should be used within limits which are not spoiled remarkably. Moreover, it is desirable to use that whose mean particle diameter is about 5-30 micrometers as such a mat agent.

[0064] After covering paper with polyolefin resin in the case of the base material which covered with polyolefin resin especially both sides of paper which are desirable base materials, it is desirable on a front face to carry out mold attachment.

[0065] After extruding and coating the polyolefin resin to which the typical approach of carrying out mold attachment fused irregularity on the base paper on the polyolefin resin front face beforehand, it is carried out by carrying out a pressure welding to a mold attachment roller, and performing encaustic attachment of detailed irregularity.

[0066] Although there are the approach of carrying out embossing calender processing near a room temperature at the resin coat paper obtained by carrying out melting extrusion and the approach of forming irregularity while cooling using the cooling roll which gave the concavo-convex pattern to the roll surface at the time of knockout coating of polyolefin resin as approach of performing this encaustic attachment, it is desirable from the ability for the latter to carry out mold attachment by the comparatively weak pressure, and perform moreover more exact and homogeneous mold attachment.

[0067] Although the relation of the irregularity of a support surface and an ink absorption layer front face is based also on the property of an ink absorption layer, when it is the porous anodic oxide film which an ink absorption layer has high ink rate of absorption, and has the opening where a high definition print is obtained, since desiccation thickness becomes thick, the inclination for the difference of elevation of the front face by the side of an ink absorption layer to decrease is larger than the difference of elevation of a support surface.

[0068] The record medium of invention of claim 2 of this invention makes it indispensable for center line average-of-roughness-height  $R_a$  when measuring the measurement die length specified to JIS-B -0601 of the base material to be used with 2.5mm and the cut-off value of 0.8mm to be 1.0-5.0 micrometers.  $R_a$  is 1.0-4.0 micrometers especially preferably.

[0069] The record medium of invention of claim 2 of this invention produced using such a base material makes it indispensable to make specular gloss by JIS-Z -8741 of the near front face where an ink absorption layer exists 10 - 30%.

[0070] Moreover, the following are mentioned as a desirable mode of this invention. The measurement die length as which the front face of the side which has an ink absorption layer is specified to JIS-B -0601 Namely, 2.5mm, It has an ink absorption layer on the base material whose center line average of roughness height ( $R_a$ ) when measuring with the cut-off value of 0.8mm is 1.0-5.0 micrometers. The measurement die length as which the front face of the ink jet record medium by the side of this ink absorption layer is specified to JIS-B -0601 2.5mm, The center line average of roughness height ( $R_a$ ) when

measuring with the cut-off value of 0.8mm is the ink jet record medium characterized by being 10 - 30% about the 60-degree specular gloss by 0.8-4.0 micrometers and JIS-Z-8741.

[0071] Next, the ink absorption layer prepared on a base material is explained. Although the ink absorption layer may be prepared only in one side of a base material, you may prepare in both sides. The ink absorption layer prepared in both sides at this time may be the same, and may differ.

[0072] An ink absorption layer is roughly divided into a swelling layer type ink absorption layer and an opening mold ink absorption layer like the above-mentioned.

[0073] Since the advantage which can manufacture the features of a swelling mold ink absorption layer by that high glossiness is acquired, that mass ink is absorbable if it is the range which can swell a polymer since the bloating tendency polymer is used, and low cost mentions and \*\*\*\* is using the bloating tendency polymer, a light-fast point is inferior.

[0074] On the other hand, it is mentioned that ink rate of absorption is quick and nonuniformity cannot produce the features of an opening mold ink absorption layer easily at the time of a print, that the front face has got dry seemingly immediately after a print, that both water resisting property and ink rate of absorption can be satisfied with coincidence, etc.

[0075] It is desirable from an image quality side that it is high absorption and quantity drying in this invention, and is the ink absorption layer of an opening mold.

[0076] A swelling mold ink absorption layer mainly consists of hydrophilic polymers which have bloating tendency to an ink solvent. As such a hydrophilic polymer, gelatin (alkali treatment gelatin, acid-treatment gelatin, derivative gelatin that blocked the amino group by phenyl isocyanate, phthalic anhydride, etc.), polyvinyl alcohol (whenever [ 300-4000, and saponification ] has [ average degree of polymerization ] 80 - 99.5 desirable%), a polyvinyl pyrrolidone, polyethylene OREN oxide, hydroxyl ethyl cellulose, an agar, a pullulan, a dextran, an acrylic acid, a carboxymethyl cellulose, casein, an alginic acid, etc. are mentioned, and two or more kinds can also be used together.

[0077] Although a swelling mold ink absorption layer may be made to contain particles, such as a non-subtlety particle and an organic particle, in the range which does not affect the bloating tendency of a hydrophilic polymer, it is usually below 100 mass % to a hydrophilic binder.

[0078] The amount of the hydrophilic polymer used prepared in a swelling layer is 3-20g usually per two 5-15g preferably 1m of record media.

[0079] An opening mold ink absorption layer has the desirable thing of a porous anodic oxide film which has an opening in an ink absorption layer and has an opening containing a non-subtlety particle and a small amount of hydrophilic polymer.

[0080] As an example of such a non-subtlety particle, white inorganic pigments, such as precipitated calcium carbonate, whiting, a magnesium carbonate, a kaolin, clay, talc, a

calcium sulfate, a barium sulfate, a titanium dioxide, a zinc oxide, zinc hydroxide, zinc sulfide, zinc carbonate, a hydrotalcite, aluminum silicate, the diatom earth, a calcium silicate, a magnesium silicate, synthetic amorphous silica, colloidal silica, an alumina, a colloidal alumina, pseudo-boehmite, an aluminum hydroxide, a lithopone, a zeolite, and a magnesium hydroxide, etc. can be mentioned, for example.

[0081] Even if it uses such a non-subtlety particle with a primary particle, and where secondary floc is formed, it can also be used.

[0082] In this invention, synthetic amorphous silica, colloidal silica, or pseudo-boehmite is desirable, and the silica, colloidal silica, and pseudo-boehmite by which especially mean particle diameter (mean particle diameter here points out the mean particle diameter of secondary floc when it exists by the primary particle among an ink absorption layer, and it exists the mean particle diameter of a primary particle in the state of secondary floc) was compounded by the gaseous-phase method 100nm or less are more desirable than the viewpoint which can form a detailed opening especially. Furthermore, the silica by which mean particle diameter was compounded by the gaseous-phase method 100nm or less is desirable at especially the point that does the effectiveness of this invention so more.

[0083] The mean particle diameter of a non-subtlety particle observes the cross section and front face of the particle itself or an opening layer with an electron microscope, and is called for as the arithmetic average value (individual number average) in quest of the particle size of the particle of 100 arbitration. The particle size of each [ here ] is expressed with the diameter when assuming a circle equal to the projected area.

[0084] Although the thing same as a hydrophilic polymer used for an opening layer as the hydrophilic polymer used in a swelling mold ink absorption layer is used, a desirable hydrophilic polymer is polyvinyl alcohol.

[0085] Denaturation polyvinyl alcohol, such as anion denaturation polyvinyl alcohol which has the polyvinyl alcohol which carried out cation denaturation of the end other than the usual polyvinyl alcohol obtained by hydrolyzing polyvinyl acetate, and an anionic radical, is also contained in the polyvinyl alcohol preferably used by this invention.

[0086] 300 or more things are preferably used for average degree of polymerization, and, as for the polyvinyl alcohol obtained by hydrolyzing vinyl acetate, the thing of 1000-5000 is preferably used especially for average degree of polymerization.

[0087] Whenever [ saponification ] has 70 - 100% of desirable thing, and 80 - 99.5% of especially its thing is desirable.

[0088] Moreover, the ratios of the non-subtlety particle and the hydrophilic binder which are used for an ink absorption layer are usually 2:1-10:1 in a mass ratio, and 3:1-8:1 are especially desirable.

[0089] An ink absorption layer can attain high voidage by making the ratio to the hydrophilic binder of a non-subtlety particle into the large value like the above. Desirable voidage is 40 - 80%, and is especially desirable. [ 50 - 70% of ] Voidage is the

value acquired according to the following formulas.

[0090] Voidage =  $100 \times \frac{[(\text{all desiccation thickness} - \text{spreading solid content thickness})]}{(\text{all desiccation thickness})}$

Moreover, when the above-mentioned opening layer contains polyvinyl alcohol as a hydrophilic polymer, in order to improve the film formation nature of a coat and to raise the reinforcement of a coat, it is desirable to add a hardening agent, for example, it is desirable for an epoxy compound, a way acid, or its salt to be mentioned, and to contain a way acid or its salt especially. As a way acid or its salt, the oxygen acid which uses a boron atom as a neutral atom, and its salt are shown, and an alt. way acid, a meta-way acid, a way [ degree ] acid, tetraboric acid, 5 way acids, and those salts are specifically contained.

[0091] although the amount of a boric acid or its salt used may change extensively with the amount of the non-subtlety particle of coating liquid, or a hydrophilic polymer -- a hydrophilic polymer -- receiving -- usually -- one to 60 mass % -- it is five to 40 mass % preferably.

[0092] As for ink rate of absorption, in this invention, it is desirable that it is the porous anodic oxide film with which an ink absorption layer has an opening also from there being comparatively little generating of curl since there is comparatively little amount of the hydrophilic polymer used that it is quick and there is little nonuniformity of an image.

[0093] In the ink absorption layer of the ink jet record medium of this invention, various kinds of additives other than the above can be added.

[0094] Especially, a cation mordant is desirable in order to improve the water resisting property and moisture resistance after printing. Although the polymer mordant which has the class [ 1st ] - 3rd class amino group and a quarternary-ammonium-salt radical as a cation mordant is used, since there being little discoloration by the passage of time and light-fast degradation and the mordanting ability of a color are high enough, the polymer mordant which has a quarternary-ammonium-salt radical is desirable.

[0095] A desirable polymer mordant is obtained as the homopolymer of the monomer which has the above-mentioned quarternary-ammonium-salt radical, a copolymer with other monomers, or a condensation polymerization object.

[0096] In addition to the above, for example, an ultraviolet ray absorbent given in JP,57-74193,A, a 57-87988 official report, and a 62-261476 official report, JP,57-74192,A, a 57-87989 official report, a 60-72785 official report, The fading inhibitor indicated by a 61-146591 official report, JP,1-95091,A, the 3-13376 official report, etc., An anion, a cation or the various surfactants of non-ion, JP,59-42993,A, The fluorescent brightener indicated by a 59-52689 official report, a 62-280069 official report, a 61-242871 official report, JP,4-219266,A, etc., Various well-known additives, such as lubricant, such as a defoaming agent and a diethylene glycol, antiseptics, a thickener, an antistatic agent, and a mat agent, can also be made to contain.

[0097] In applying an ink absorption layer on a base material, it is the purposes, such as

enlarging bond strength between a front face and a spreading layer, and it is desirable to perform corona discharge treatment, undercoating processing, etc. to a base material. [0098] In order to adhere at the time of piling up immediately after curl prevention or printing to the side and the opposite side which have the ink absorption layer of the ink jet record medium of this invention and to raise a \*\* ink imprint further, the back layer of various classes can be prepared.

[0099] Although the configuration of a back layer changes also with the class of base material, thickness, and the configuration and thickness on a side front, generally a hydrophilic binder and a hydrophobic binder are used. The range of the thickness of a back layer is usually 0.1-10 micrometers.

[0100] Moreover, it adheres to a back layer as other record media, and it is still more desirable prevention, note nature amelioration, and to carry out surface roughening of the front face because of conveyance nature amelioration within an ink jet recording device. The organic or inorganic particle whose particle size is 2-20 micrometers is preferably used for this purpose.

[0101] These back layers may be prepared beforehand, and after they apply the spreading constituent of this invention, they may be prepared.

[0102] As a spreading method of an ink absorption layer, the extrusion coat method which uses a hopper the roll coating method, a rod bar coating method, the air-knife-coating method, a spray coating method, the curtain method of application, or given in a U.S. Pat. No. 2,681,294 official report is used preferably.

[0103] When using polyolefin resin coat paper as a base material, as for desiccation, it is desirable to dry in 0-80 degrees C in general. If 80 degrees C is exceeded, polyolefin resin softens, conveyance will be made difficult or nonuniformity will appear in the gloss on the front face of a recording layer. A desirable drying temperature is 0-60 degrees C.

[0104]

[Example] Although an example is given to below and this invention is concretely explained to it, the embodiment of this invention is not limited to these. In addition, in an example, especially, as long as there is no notice, bone-dry mass % is shown"%."

[0105] Example 1 water content extruded at the rear face of the stencil paper for photographs of basis-weight 170 g/m<sup>2</sup> of 6.5 mass %, and the consistency applied the low density polyethylene of 0.92 by the thickness of 30 micrometers by the applying method. Subsequently, the base material which the consistency of which anatase mold titanium oxide 5.5 mass % content is done applied the low density polyethylene of 0.92 to the side front by the melting extrusion applying method by the thickness of 35 micrometers, and covered both sides with polyethylene was produced. Various mold attachment processings were performed on the polyethylene front face, cooling immediately after melting extrusion spreading using the cooling roll which has the height of various regular irregularity on the surface of a front face. The difference in mold attachment was performed by adjusting the height of a consistency and

irregularity.

[0106] After performing corona discharge on the side front and performing corona discharge for a gelatin under-coating layer also at 0.3 g/m<sup>2</sup> and the rear face, the latex layer was applied so that thickness might grow into 0.2 g/m<sup>2</sup>.

[0107] Next, the coating liquid of the following presentation was prepared on the side front.

The sodium tripolyphosphate of pH=7.5 for 20kg (Ishihara Sangyo make: W-10) of titanium oxide whose "preparation of titanium oxide dispersion liquid -1" mean diameter is about 0.25 micrometers 150g, Polyvinyl alcohol (Kuraray Co., Ltd. make-VA235) 500g, After it added 150g and the SANNOBUKO, Inc. defoaming agent of a cationic polymer (p-1), and SN381 to water-solution 90L containing 10g and the high-pressure homogenizer (the Sanwa Industries nature) distributed, 100L was made to the whole quantity and uniform titanium oxide dispersion liquid -1 were obtained.

[0108] After carrying out suction distribution at a room temperature into the pure water of 600L to which the mean diameter of "preparation of silica dispersion liquid -1" primary particle adjusted to pH=3.0 gaseous-phase method silica (Japanese Aerosil Industries make: A300) 125kg which is about 0.007 micrometers with the nitric acid using the jet stream inductor mixer TDS by Mitamura Riken Industries, 660L was made to the whole quantity with pure water.

[0109] It added stirring 66.0L of silica dispersion liquid -1, and subsequently, water-solution 7.0L containing 260g of boric acids and 230g of boraxes was added to water-solution (pH=2.3) 15L which contains 1.29kg, ethanol 4.2L, and n-propanol 1.5L for "preparation of silica dispersion liquid -2" cationic polymer (P-1), and the 1g of the aforementioned defoaming agents SN381 was added to it.

[0110] The high-pressure homogenizer by Sanwa Industries distributed this mixed liquor, 90L was made to the whole quantity with pure water, and silica dispersion liquid -2 were prepared.

[0111] The heating dissolution of oil solubility fluorescent brightener UVITEX-alumnus by "preparation of fluorescent brightener dispersion liquid -1" Ciba-Geigy, Inc. and the 400g was carried out at di-isodecyl phthalate 9000g and ethyl-acetate 12L, addition mixing of this was carried out at water-solution 65L containing acid-treatment gelatin 3500g, a cationic polymer (P-1), a saponin 50% water solution, and 6,000ml, emulsification distribution was carried out with the high-pressure homogenizer by Sanwa Industries, and 100L was made to the whole quantity after removing ethyl acetate by reduced pressure.

[0112] the methacrylic ester system mono dispersion mat agent made from the "preparation of mat agent dispersion liquid -1" total \*\*\*\*\*, Inc. -- the inside of pure-water 7L which contains 3g of said PVA(s)235 for 156g of MX-1500 (mean particle diameter of 15 micrometers) -- adding -- a high-speed homogenizer -- distributing -- the whole quantity -- 7.8L -- finish wooden clogs.

[0113] "Preparation which is coating liquid" The coating liquid of the 1st layer, the 2nd



layer, and the 3rd layer was prepared in the following procedures.

[0114] Coating liquid for the 1st layer: Sequential mixing of the following additives was carried out, stirring at 40 degrees C to 560ml of silica dispersion liquid -2.

[0115]

\*\* Polyvinyl alcohol (the Kuraray Industries make-VA203)

10% water solution of \*\*: 0.6ml \*\* polyvinyl alcohol (the Kuraray Industries make-VA235)

5% water solution of \*\*: 260ml \*\* fluorescent brightener dispersion liquid - One: 22ml \*\* titanium oxide dispersion liquid - One: The first 40ml \*\* industrial incorporated company make : A latex emulsion and AE-803 : 1000ml is made to the whole quantity with 24ml \*\* pure water.

[0116] Coating liquid for the 2nd layer: Sequential mixing of the following additives was carried out, stirring at 40 degrees C to 650ml of silica dispersion liquid -2.

[0117]

\*\* Polyvinyl alcohol (the Kuraray Industries make-VA203)

10% water solution of \*\*: 0.6ml \*\* polyvinyl alcohol (the Kuraray Industries make-VA235)

5% water solution of \*\*: 270ml \*\* fluorescent brightener dispersion liquid -1: 1000ml is made to the whole quantity with 30ml \*\* pure water.

[0118] Coating liquid for the 3rd layer: Sequential mixing of the following additives was carried out, stirring at 40 degrees C to 650ml of silica dispersion liquid -2.

[0119]

\*\* Polyvinyl alcohol (the Kuraray Industries make-VA203)

10% water solution of \*\*: 0.6ml \*\* polyvinyl alcohol (the Kuraray Industries make-VA235)

5% water solution of \*\*: 270ml \*\* silicon dispersion liquid (-[ by Dow Corning Toray Silicone, Inc. ] BY- 22 -839) : 3.5ml \*\* saponin 50% water solution : 4ml \*\* mat agent dispersion liquid -1: 1000ml is made to the whole quantity with 10ml \*\* pure water.

[0120] The coating liquid obtained as mentioned above was filtered with the following filter.

The 1st layer and the 2nd layer: It is two steps of 3rd layer at TCP10 by Toyo Roshi Kaisha, Ltd. : Coincidence spreading of each class was carried out so that it might become the order of the 1st layer (40 micrometers), the 2nd layer (110 micrometers), and the 3rd layer (30 micrometers) to the above-mentioned base material which covered both sides with TCP30 by Toyo Roshi Kaisha, Ltd. with two-step polyolefine. The inside of a parenthesis shows each humid thickness.

[0121] Spreading performed each coating liquid at 40 degrees C, and applied with the three-layer type slide hopper, after cooling for 20 seconds in the cooling zone kept at 8 degrees C immediately after spreading and carrying out [ a 20-30-degree C wind ] Junji Hazama desiccation for 60 seconds by the 50-degree C wind for 60 seconds by the 45-degree C wind for 60 seconds, 23 degrees, gas conditioning was carried out at 40 -

60% of relative humidity, and the record medium was obtained. It checked that the third layer was a porous coat from the first pass. In addition, the mass ratio of a particle and a hydrophilic binder is 6.0 at this time, and voidage is a record medium. - Both 1-10 were about 60%.

[0122] The glossiness (60 degrees) of the average of roughness height (Ra) of the front face by the side of \*\* ink absorption layer and the front face by the side of \*\* ink absorption layer was measured about each obtained record medium.

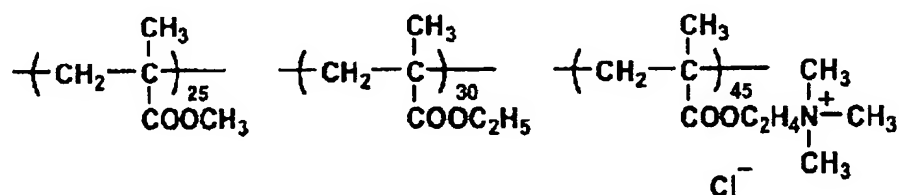
[0123] Moreover, black solid printing and green solid printing were performed in the ink jet printer by Seiko Epson, Inc., and PM770C, and the 60-degree glossiness of a \*\* black solid printing part was measured. Moreover, the nonuniformity of a \*\* green solid printing part and the gloss difference of the \*\* black solid printing section and the non-printed section were judged visually.

[0124] A result is shown in Table 1. The criteria of a visual judgment of the gloss difference of front Naka, green solid printing section nonuniformity, the black solid printing section, and the non-printed section are based on below.

[0125] green solid printing section nonuniformity: -- A: -- B: which cannot identify nonuniformity -- although nonuniformity is sensed a little -- practically -- problem-less C: -- B: as which most gloss difference: A: gloss differences of the black solid printing section with a problem and the non-printed section are not sensed practically -- although there is a gloss difference a little -- practically -- problem-less C: -- practically -- problematic -- D: -- it is a remarkable big problem -- in addition The average of roughness height (Ra), specular gloss: It is measurement [0126] with the approach specified on this application specifications.

[Formula 1]

P-1



[0127]

[Table 1]

記録媒体	R <sub>a</sub> ( $\mu$ m)	光沢度 (%)		緑ベタ部ムラ	光沢差
		印字前	黒ベタ部		
- 1 (本発明)	1.25	15.2	17.2	A	A
- 2 (本発明)	1.45	21.6	22.9	A	A
- 3 (本発明)	2.41	15.2	15.9	A	A
- 4 (本発明)	2.73	23.5	24.1	A	A
- 5 (本発明)	0.86	27.5	31.1	A	B
- 6 (本発明)	3.27	11.1	11.6	B	A
- 7 (比較例)	0.72	13.2	17.8	A	C
- 8 (比較例)	1.34	7.5	12.3	A	D
- 9 (比較例)	4.21	15.6	16.3	C	A
- 10 (比較例)	0.10	32.0	41.5	C	D

[0128] Ra: Record medium of this invention which is in within the limits whose specular gloss of the front face by the side of the ink absorption layer before printing it is Ra=0.8-4.0micrometer and is 10 - 30% from the result of the granularity table 1 of the front face by the side of an ink absorption layer - It turns out that a gloss difference with the black solid section is small, and a flash hardly produces 1-6 in the shape of an image.

[0129] Moreover, record medium of this invention - It turns out that the print of the particle side where there is little nonuniformity in the green solid printing section according [ 1-6 ] to surface irregularity, and it is highly defined is obtained. Record medium Ra=0.9-3.0micrometer and whose glossiness are 12 - 25% especially - It turns out that 1-4 are more good.

[0130] On the other hand, in a record medium -7 (Ra is [ less than 0.8 micrometers and ] glossiness =13.2%), the rise of the glossiness of a printing part is large and a flash becomes image-like a problem.

[0131] Moreover, also with a record medium -8 (Ra=1.34micrometer and glossiness are less than 10%), a gloss difference is large similarly, in feeling of \*\*, only a part with low gloss from the first becomes remarkable, and a gloss difference spoils print grace for it greatly.

[0132] Furthermore, in a record medium -9 (Ra exceeds 4 micrometers), a concavo-convex difference is too high, the nonuniformity of a green part is remarkable, and a high-definition print is not obtained.

[0133] Furthermore, in the record medium -9, about 40 very small cracks per two whose sizes are about 0.5-2mm had arisen 1m of record media (record medium - 1-8 3-10 points). (Viewing estimates)

In producing the base material used in the example 2 example 1, the base material which carried out mold attachment processing with a desired cooling roll and which was made into the shape of irregular toothing as shows Ra of a base material in Table 2 was prepared. The record medium shown in Table 2 like an example 1 was produced except using this base material.

[0134] It is similarly estimated as an example 1 and a result is shown in the following table 2.

[0135]

[Table 2]

記録媒体	Ra (μm)		光沢度 (%)		緑ベタ部 ムラ	光沢差
	支持体	記録用紙	印字前	黒ベタ部		
-11(本発明)	1.64	1.31	13.7	15.0	A	A
-12(本発明)	1.52	1.25	23.2	24.9	A	A
-13(本発明)	4.16	2.27	15.0	15.8	A	A
-14(本発明)	3.22	1.87	21.7	22.8	A	A
-15(本発明)	1.60	1.27	28.8	32.3	A	B
-16(本発明)	1.87	1.35	11.2	13.6	B	A
-17(比較例)	0.70	0.74	13.2	16.9	A	C
-18(比較例)	1.72	1.22	8.2	12.0	A	C
-19(比較例)	5.52	4.18	13.1	14.2	C	A

[0136] As for the record medium of this invention, it turns out like an example 1 that the effectiveness of this invention is acquired so that clearly from the result of Table 2.

[0137] In example 3 example 1, as a result of producing a sample like an example 1 except having removed the mat agent of the 3rd layer of the ink absorption layer of each sample and carrying out the same evaluation as an example 1, as for the record medium of this invention, the effectiveness of this invention as well as an example 1 was acquired.

[0138] In producing the base material which applied polyethylene by the dissolution extrusion applying method, and covered both sides with polyethylene, in the base material used in the example 4 example 1, it cooled immediately after melting extrusion spreading using the smooth cooling roll. That is, the base material was produced by the same approach as the base material produced in the example 1 except producing without carrying out mold attachment processing of the front face.

[0139] Thus, coincidence spreading of the 3rd layer was carried out from the 1st layer like production of the record medium -1 in an example 1 on the produced base material. Spreading performs each coating liquid at 40 degrees C, and applies with a three-layer type slide hopper. After cooling for 20 seconds in the cooling zone kept at 8 degrees C immediately after spreading, a 20-30-degree C wind is sprayed. After cooling using the cooling roll which has the height of various regular irregularity on a front face after drying to extent in which a front face is not sticky, the record medium which carries out gas conditioning at 40 - 60% of 23-degree-C relative humidity and which is shown in Table 3 was obtained. The glossiness (60 degrees) of the average of roughness height (Ra) of the front face by the side of an intermediary and \*\* ink absorption layer and the front face by the side of \*\* ink absorption layer was measured to each record medium, and the 60-degree glossiness of a \*\* black solid printing part was measured, and the nonuniformity of a \*\* green solid printing part and the gloss difference of the \*\* black solid printing section and the non-printed section were judged visually.

[0140] In addition, ink absorptivity was evaluated about the above-mentioned record

medium. The coefficient of water absorption of the evaluation ink absorption layer of ink absorptivity was measured by the following approaches, and ink absorptivity was evaluated.

[0141] About each record medium of 10cm around, the mass at the time of desiccation (a) was measured. It dipped in pure water for 30 seconds after that, surface water was wiped, and the mass after flood (b) was measured.

[0142] The mass (c) of only a base material without an ink absorption layer was measured. Then, water absorption was calculated according to the following formulas. In addition, since the base material used by this example was a non-absorptivity base material, the own coefficient of water absorption of a base material was taken as zero.

[0143] Water absorption = (b-a)/(a-c) (the water absorption of each record medium is shown in Table 3)

An evaluation result is shown below.

[0144]

[Table 3]

記録媒体	Ra ( $\mu$ m)	光沢度 (%)		緑ベタ部ムラ	光沢差	吸水性
		印字前	黒ベタ部			
—21(本発明)	1.25	15.2	17.2	A	A	1.24
—22(本発明)	1.45	21.4	23.1	A	A	1.24
—23(本発明)	2.41	15.0	15.7	A	A	1.23
—24(本発明)	2.73	23.8	24.6	A	A	1.22
—25(本発明)	0.86	27.4	31.4	A	B	1.24
—26(本発明)	3.27	11.3	11.7	B	A	1.23
—27(比較例)	0.72	13.3	17.8	A	C	1.27
—28(比較例)	1.34	7.5	12.3	A	D	1.24
—29(比較例)	4.21	15.4	16.2	C	A	1.22
—30(比較例)	0.10	32.0	41.4	C	D	1.30

[0145] In addition, record medium produced in the example 1 - It is a record medium as a result of measuring water absorption the same also about 1-10. - 1-10 were all about 1.30.

[0146] It is related with nonuniformity and gloss so that clearly from the result of Table 3, and it is a record medium. - Record medium [ in / 30 / 21- / an example 1 ] - The same inclination as 1-10 is shown, and it turns out that the record media 21-26 of this invention show the effectiveness of this invention. However, record medium presumed that voidage falls - The water absorption of 21-30 is the record medium of an example 1. - The water absorption of 1-10 shows that it is a little small.

[0147]

[Effect of the Invention] Without producing a gloss difference remarkable in the shape of an image in the print section and the non-printing section, the image which improves the flash by surface gloss, moreover does not have image nonuniformity, and has a high-class feeling is obtained, and the ink jet record medium by this invention has the outstanding effectiveness.

# JIS

The text in Japanese of this English version  
has been withdrawn. May, 2003

## JAPANESE INDUSTRIAL STANDARD

Testing Method for ~~Opacity~~ of Paper

**JIS** P 8138-1976  
(Reaffirmed: 1984)

Translation without guarantee  
In the event of any doubt arising, the original  
standard in Japanese is to be evidence

Translated

by

Japanese Standards Association

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## JAPANESE INDUSTRIAL STANDARD

J I S

## Testing Method for Opacity of Paper

P 8138-1976  
(Reaffirmed: 1984)1. Scope

This Japanese Industrial Standard specifies the testing method for opacity of paper.

The opacity herein means as follows: Apply paper packings of white and black standard plate to the sample and measure the respective reflectances by using green filter and express the ratio of the latter to the former by-% to take it as the opacity, and further that indicates 100 % is taken as completely opaque paper.

2. Apparatus

The apparatus shall be as follows:

- (1) Hunter Reflectometer The Hunter reflectometer specified in JIS P 8123. However, the spectral transmissivity curve of green filter and spectral characteristic curve of light source-green filter-photovoltaic cell are as given in Attached Fig. 1 and attached Fig. 2.
- (2) Paper Backing Standard Plate
  - (a) White Plate The white plate of reflectance of 89 % when green filter is used shall be taken as standard. The white plate is generally made of white glass, but it may be made of colourless glass container (length 80 mm, width 100 mm, thickness 10 mm) filled with white powder.
  - (b) Black Plate The black plate of reflectance of not more than 0.5 % when green filter is used shall be taken as standard. The black plate is generally made of glass, but it may be made of plate stuck with black velvet (80 mm x 100 mm) with upper sticking colourless glass plate.

3. Test Piece

The test piece shall be of 100 mm x 80 mm and 5 sheets shall be so made that its long side direction becomes longitudinal direction of paper. The measuring surface shall be free from abnormalities to affect correctness of test results such as watermarks, dirt, spots, blots, etc. Further, the finger or stain matter, etc. shall not be touched and the harmful influence such as high temperature or strong light shall be prevented.

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Applicable Standards:

JIS P 8123-Testing Method for Brightness by Hunter of Paper and Pulp

JIS Z 8401-Rules for Rounding off of Numerical Values

#### 4. Operation

The procedures of measurement shall be carried out in accordance with Hunter whiteness testing method, as appropriate, and the measurement of opacity, carried out according to either one of the following two methods.

##### (1) Method A

- (a) In accordance with Hunter whiteness test method, as appropriate, carry out the standardizing operation of instrument by using green filter.
- (b) Overlap the sample on the paper backing white plate to apply to the sample hole, and measure its reflectance ( $R_{0.00}$ ).

In this case, let the face including incident rays and reflected rays become the longitudinal direction of sample, and let the surface of sample be toward incident light.

- (c) Overlap the sample on the paper backing black plate and measure the reflectance ( $R_0$ ).
- (d) According to this method, measure on five sheets of test piece.

##### (2) Method B

- (a) In accordance with Hunter whiteness test method, as appropriate, carry out the standardizing operation of instrument by using green filter.
- (b) Overlap the sample on the paper backing white plate to apply to the sample hole, and coincide it reflectance with 100 of graduation.

In this case, let the face including incident rays and reflected rays become the longitudinal direction of sample, and let the surface of sample be toward incident light.

- (c) Overlap the sample on the paper backing black plate and measure the reflectance. The reflectance at this time is the opacity.
- (d) According to this method, measure on five sheets of test piece.

#### 5. Report

The opacity (%) C according to Method A shall be calculated according to the following formula, and that according to Method B the measured values as they are, and their average value, be rounded to one place of decimal according to JIS Z 8401 to report.



$$C = \frac{R_0}{R_{0.11}} \times 100$$

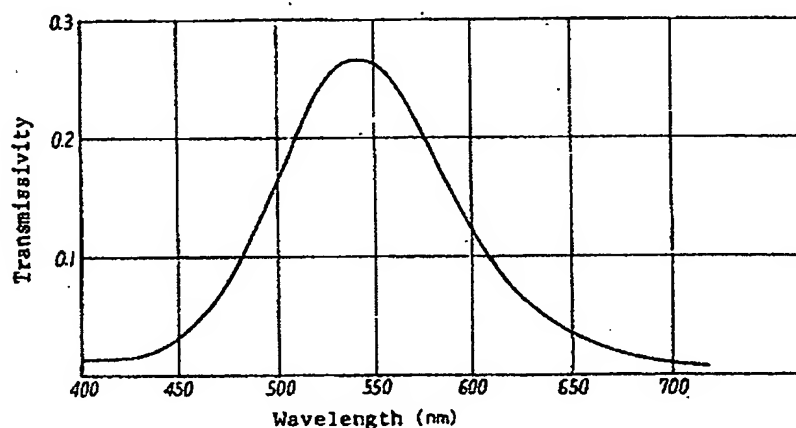
where  $R_0$ : reflectance of sample when paper backing black plate is used

$R_{0.11}$ : reflectance of sample when paper backing white plate is used

Further, if required, the maximum value and the minimum value shall be described.

In the case where the sample has special characteristics on appearance, it also shall be described.

Attached Fig. 1. Spectral Transmissivity of Green Filter



Attached Fig. 2. Spectral Characteristic Curve for Light Source-Green Filter-Photovoltaic Cell

